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ABSTRACT

The Cornell Theory Center (CTC) began offering asynchronous distance learning over the Web in 1995, with its first offering of the Virtual Workshop. The Virtual Workshop is a Web-based set of modules used to provide distance education in high-performance computing. One technique that is currently being incorporated is the use of video clips. CTC is currently working with two types of clips. The first type is screen and audio capture for tool demonstration. The second is using a film clip of a speaker in conjunction with other Web-based materials. This paper describes the video clips, why they are used, how they are incorporated into existing online materials, design issues, and evaluation plans. (Author/AEF)

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Enhancing Web-Based Materials with Video Clips

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Abstract: The Virtual Workshop is a Web-based set of modules used to provide distance education in high-performance computing. One technique we are currently incorporating is the use of video clips. We are working with two types of clips. The first type is screen and audio capture for tool demonstration. The second is using a film clip of a speaker in conjunction with other Web-based materials. This paper describes the video clips, why they are used, how they are incorporated into existing online materials, design issues, and evaluation plans.

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Background: CTC and the Virtual Workshop

The Cornell Theory Center (CTC) began offering asynchronous distance learning over the Web in 1995, with its first offering of the Virtual Workshop. To date, we have conducted fifteen Virtual Workshops for over 1000 participants. Participants typically are undergraduate through Principal Investigator in academia, or a researcher or scientist in a corporate or government office. These workshops cover various topics in High-Performance Computing. Each workshop is comprised of about ten modules, delivered over the course of four to eight weeks. Our courses are taken by those seeking professional development in high-performance topics, and those who more specifically want to learn how to use CTC resources. Those who complete a course are awarded a certificate. We initially offered web-based workshops to reach people who could not travel to Ithaca for training, but we now find that many people prefer the medium, progressing at their own speed, and being able to take portions of the course at any hour.

A goal in the Virtual Workshop evolution is experimentation with techniques intended to provide more interaction, as well as options for participants with different learning styles. Features we have added include

- Glossary, written in JavaScript. The definition appears by either hovering the mouse over or clicking on a glossary term.
- Interactive quizzes, written in VBScript. The quizzes are multiple choice forms. Submitting the quiz form automatically grades the quiz and returns a list of questions that were answered incorrectly, with optional explanations. The results are also written to a database, enabling us to review results for problem concepts.
- Personalized detail level with JavaScript. Easily moving between an outline version and a detailed version of the materials allow workshop participants to move through a topic in a way that best suits their learning style and needs.
- Animations using flash, QuickTime. Animations enhance the text description of a concept and break up pure reading material.
- MOO/Chat/ - Discussion Forums. We have experimented with various forums to provide consulting, as well as to promote discussion among the participants.
- Virtual Workshop Companion, utilizing Java programs and Perl scripts. Provides the ability to edit, compile, set run-time parameters such as number of processors, and submit a program, all without leaving the Web browser, via secure authentication.

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One of the features we have used for about five years is the addition of video clips. Video clips are most often used to enhance a portion of a topic rather than provide a full presentation, e.g.,the majority of a module is text, with a video included to introduce the topic or explain an important or difficult concept. The clips most often contain a speaker, screen capture, or motion graphics.

Unfortunately, using video clips has had a number of drawbacks: a few years ago, even short clips were very large, and could rarely be downloaded over most participants' network connections, and players were

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not available across all platforms. In development, it was time consuming and difficult to pair video clips with supporting materials, such as Web pages or slides. Network and desktop improvements have largely solved the first two problems, and we began to investigate solving the third.

Finding the Right Tool: Develop or Purchase?

The features we most wanted when playing the clip were:

- The ability to present audio, video, and a Web page or slide together on the Web page
- Synchronization of Web pages with video and/or audio
- The ability to focus attention on different parts of the Web page or slide at specified points during the clip. This would be used sparingly to focus attention, not to the point of annoyance.
- The ability to easily use the controls to stop, start, pause, resume, forward, and rewind the clip. At the same time, total length and current progression through the clip should always be visible. With these features, there is no need for slow motion. If the viewer doesn't understand or misses something, they can simply rewind and replay.
- The inclusion of a table of contents or index, which will allow the viewer to either jump into the desired section directly, or to view the whole segment in one piece.

We began the task of writing scripts to create such a presentation scheme. However, this past November, a new tool became available that meets all of our requirements for video clip creation and display: Microsoft® Producer for PowerPoint® 2002. In addition, this tool allows us to easily add audio, video, and screen capture paired with PowerPoint or HTML pages.. These capabilities were feasible to develop, but using this tool makes it much more cost-effective. Therefore we are now able to add video clips to Web pages where it makes most sense.

Description of the Video Clips

We are designing and producing a variety of video clips. The video clips will be used to enhance existing online materials, and will occasionally provide full lectures. The video clips are intended to improve our online educational materials by making the content more engaging and easier to understand. Two types of video enhancement we've been working with for several years now are speaker video or audio only, and screen capture.

Some web design sources, such as (Horton 2000) recommend video be used only as a last resort, for several well-founded reasons, including bandwidth requirements and production expense. This source and feedback received to date firm our preference for including short clips, only where most needed.

Screen Capture Video Clip

Capturing a computer screen session is a common feature in tools such as SnagIt from TechSmith®. Most file types created using these tools can be incorporated into Microsoft Producer projects, or Microsoft Producer itself can be used to capture the screen session.

Using screen capture with narration, we can record the technical expert "showing" how to use a tool or program, and hear him/her explain the process. In other words, this is a screen recording, with a speaker voice-over. Ideally, it has the effect of looking over the expert's shoulder while a tool or procedure is demonstrated and explained. Previously, our online materials covering use of graphical tools would use text and screen stills followed by a tutorial that walked the reader through the steps of a simple use of the tool. This is very tedious, error-prone, and frustrating. We feel that screen capture is a faster, more effective introduction.

Currently, our display for screen capture video clips consists of

- A video area, which should be as large as needed to see the detail of the tool being demonstrated
- An audio recording

- A table of contents, which can be omitted if the clip is very short, or the procedure cannot be broken into distinct sections
- A small HTML section which contains typical Web page information, such as date, copyright, and a link to return to the home page

Additional design possibilities we are experimenting with include:

- Offering the option to try to use the tool while viewing the demonstration.
- Using annotation such as a red circle or arrow to bring attention to portions of the screen.
- Including a set of several clips to cover different scenarios and programming languages.
- Making available supporting material, such as relevant hyperlinks.

Speaker Video Clip

Using speaker video paired with a Web page, the speaker video can assist in explaining a difficult point or be utilized to give a full talk. A speaker video can be helpful in giving the materials a human look and feel. Most of the people who use our materials never see the developers and consultants; many have never seen Ithaca. Adding a "Welcome to the Virtual Workshop" clip or a clip that introduces Virtual Workshop participants to the consultants serves to put a face on the materials, and hopefully, make them more comfortable interacting with us by email or chat room. As we all know, individuals do not all process information the same way; some learn better by reading, some by watching, some by experimenting, and of course sometimes a difficult concept only becomes clear when looking at it in a variety of ways. Our materials consist of text, pictures, animations, etc. Supplementing words and pictures with an expert speaker might provide additional help for difficult points. In the same vein, a non-gratuitous video clip can break up the monotony. Although the materials are fairly interactive, with reading, animations, simulation programs, diagrams, quizzes, and lab exercises, they can still benefit from an interlude of this type. And finally, though we intend to primarily use this tool to provide clips and not full topic lectures, some lectures will never be transformed into Web materials unless they are captured as live lectures and put online simply and easily. It is faster to videotape a live lecture and pair it with the speaker's slides than to develop web pages from the materials.

Currently, our display for speaker video clips (see Figure 1) consists of

- A video area, which can be fairly small. A head and shoulders video of a speaker can be very effective even in a small size, and many speakers are relieved to hear his/her face will not fill the screen.
- A table of contents, which we include even when the clip is very short, since it makes more sense to be able to pick and choose from a lecture. The table of contents is always placed on the left to promote the comfort level gained by displaying this piece where most people are accustomed to finding it.
- The supporting materials, either a set of Web pages or PowerPoint slides. Before we began using Microsoft Producer, we made the assumption that we would have to use HTML pages to avoid porting and converting issues. The addition of PowerPoint slides is a welcome change for some content developers, and sometimes the only way we can capture material from outside speakers. In addition, it's easier to add timed annotations to PowerPoint slides.
- A small HTML section which contains typical Web page information, such as date, copyright, and a link to return to the home page

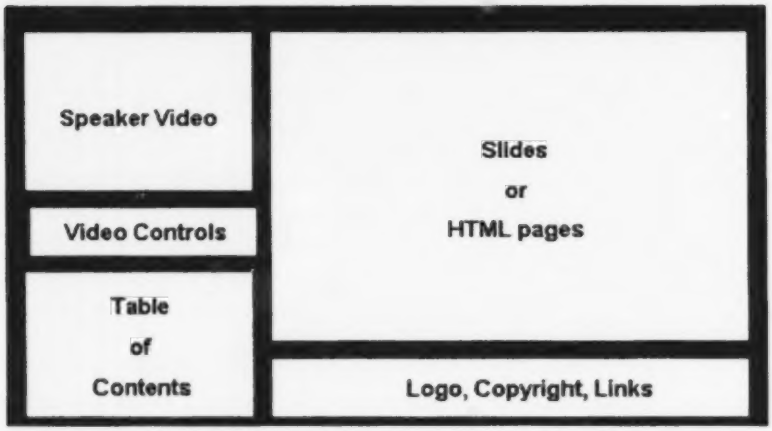

Figure 1: Diagram of display for speaker video clips

Additional design possibilities we are experimenting with are primarily in how we capture the speaker video. Methods we have, and plan to try include:

- A staged video shoot, where the speaker lectures to the camera in a quiet room. This method gives the opportunity to control the set and lighting, redo lines or whole sections, and edit the resulting video.
- Live lecture, where the speaker is talking to a live audience, and the camera is moved to the location as needed.
- Live lecture, where the room is always video-capture ready, with recording equipment always in place.

We have found that lighting is an important consideration. It is easier to adjust lighting levels in a staged video shoot than in a lecture room, where the lighting on the lecture screen often overpowers the lighting on the speaker. In delivery, the speaker in a staged shoot speaks to the person viewing the Web page, while in a live lecture the Web video often suffers. On the other hand, in a live lecture the speaker is often more animated; our speakers tend to be more wooden when speaking to a camera. Finally, in a staged shoot, the director can place the speaker in a chair; in a live shoot, the camera operator must be either very alert and skilled in tracking a moving speaker, or settle for a wide shot, resulting in a very small speaker image on the web page. However, the decision usually is not based on these issues, but rather what time, resources, and the speaker will allow.

Costs, Problems, Solutions

We began working with a browser tool and writing scripts to create the layout and presentation we were seeking. However, generalizing the scripts was time consuming, and the indexing table of contents we developed was too complicated and error-prone. In contrast, Microsoft Producer met our design goals, and is a free download for Microsoft PowerPoint 2002. To run the tool requires only Microsoft PowerPoint 2002.

To run the resulting web page requires

- Windows 98 or Windows NT 4.0 or higher
- Windows Media Player 6.4 or higher
- MSIE 5.0 or higher

This may seem like a strict set of requirements, but we felt that it would be too cost-prohibitive to develop our own tool that would reach a wider audience. Regardless of the solution, some percentage of Web page viewers would not be able to view the video clips. For clips containing content critical to the topic, we will continue to provide the materials in an alternate format, usually a series of still graphics and text.

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We have seen by entries on our registration forms that the playback restrictions still allow us to reach the majority of our users; however, we will continue to track this number, as well as results from larger online surveys. In our case, the target is the equipment in homes and offices, for both our users and our potential users. Increasingly, this type of material is being put on CD, as well, for distribution at trade shows.

Research Plans

At this point most of the major questions have been answered. We have chosen a tool to produce the video clips, decided on two basic designs, and have begun to create production pieces. However, there are further issues to investigate:

1. The types of information which benefit most, e.g. complex concepts or procedural examples
2. Most instructive video clip components, e.g. speakers, or screen capture, or audio enhancement
3. Best layout and sizing for the various components
4. Most effective clip length

We expect additional issues will arise during research.

One area discussed that has not been investigated is finding a good way to encourage and allow the viewer to try a procedure while it is being explained. This will be the next new area being investigated.

Future Work

We are currently both creating production pieces and continuing to research issues such as those described next, with the goal of continuing to improve and refine our use of video clips. Valuable suggestions for evaluating online multimedia are included in (Kennedy 1999) and (Weston 2001).

Is the layout both clear and aesthetically pleasing? Are the major elements sized appropriately? Have we chosen the most readable font type and size? Is it clear how to navigate the page? Do the controls work as expected? The first three questions can be explored by showing the test group several possible layout schemes. Navigation and video controls can be tested by first watching each tester experiment, then tracking steps taken to navigate to a particular place in the clip; did the person choose the easiest method? These evaluation methods are described as direct observation and think-aloud interviews (Weston et al. 2001). We expect that for most of these issues we have already found the best solution, because we chose the conventional layout to increase comfort from the outset; e.g. the table of contents is at the left as expected, the footer on the bottom, and the video controls have the standard look and placement.

Which playback speed gives best quality without exceeding the bandwidth limits? Is it better to have one speed that is best for the majority, to auto select a speed based on connection type, or to let the viewer choose a speed? What is the ideal length of a clip? The best overall speed is difficult to define, because there is a wide range of target hardware and software, and it keeps changing; otherwise this would be the ideal since it is the simplest, least error-prone solution. One way to learn the preferred choice is to present all of these possibilities, and track web hits for what is chosen most often. It is expected that the auto-selected speed will be most popular, because I have learned through working with small test groups that even technically-savvy people are not sure which speed is best for them; they prefer to have this choice made for them. The ideal length of a clip can be tested by both watching and testing participants. The best length is expected to be less than five minutes; anecdotal feedback confirms that if a web clip is longer, attention will stray to email and other distractions. A study on using technology for language study (Ng 2000) found that PowerPoint presentations longer than twenty minutes were found to be very boring; ten minutes or less was advised. And although the broadband connections are continually improving, it is recommended that video file sizes be no larger than 320 x 240 for higher speed connections (Williams 2002).

And most important, does the use of video clips enhance understanding? Do "friendly faces" lead to improved or increased interactions in other parts of the course? Do clips interspersed in other web materials help keep the reader engaged in the module? What types of information are best presented this way, introduction, concepts, or topics with graphic elements? Testing will consist of checking whether modules with clips are completed more often than those without, reviewing the number of questions and tone for modules

with and without a person associated, and comparing test results for modules that have video clips versus those with images and text. It is expected that this set of questions will be the most difficult to answer definitively, but that some level of improvement will be seen in all areas. A study on remote lecture presentations (Willie et al. 1999) found that presentations that include slides with sound and video have a higher hit rate than any other presentation type.

Author Biography

Susan Mehringer is a Senior Technical Consultant at the Cornell Theory Center, where she has been since 1987. Her current projects include work on the Virtual Workshop, including developing modules, consulting, and assessing WWW statistics; testing new systems and software; consulting; and developing and delivering training materials.

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